

## AIR TEMPERATURE CONTROL

### 1. GENERAL

#### A. RELATED DOCUMENTS

- 1) ALL WORK SHALL BE SUBJECT TO THE GENERAL CONDITIONS AND SHALL COMPLY WITH APPLICABLE REQUIREMENTS OF THE CONTRACT.

#### B. REFERENCE STANDARDS

- 1) MATERIAL AND INSTALLATION SHALL COMPLY WITH LATEST EDITIONS OF APPLICABLE CODES, RECOMMENDED PRACTICES AND STANDARDS OF NYCBC, ANCI, NRC, ETC., OR ASHRAE AND U.L.

#### C. SUBMITTALS

##### 1) GENERAL

- a) EQUIPMENT AND MATERIAL SUBMITTALS SHALL SHOW SUFFICIENT DATA TO INDICATE COMPLETE COMPLIANCE WITH CONTRACT DOCUMENTS AS FOLLOWS:
  - (1) PROPER SIZES AND COMPLETE PERFORMANCE DATA.
  - (2) THAT THE ITEM WILL FIT IN THE AVAILABLE SPACE, IN A MANNER THAT WILL ALLOW PROPER SERVICE.
  - (3) CONSTRUCTION METHODS, MATERIALS AND FINISHES.
  - (4) INSTALLATION INSTRUCTIONS.
  - (5) CONTROL AND WIRING DIAGRAMS.
  - (6) OPERATING INSTRUCTIONS.
- b) CATALOG DATA MUST SHOW CLEARLY MARKED THE ITEM OR NUMBER TO BE FURNISHED, WITH ALL ACCESSORIES INDICATED. ALL RELEVANT INFORMATION MUST BE MARKED OUT, LEAVING ONLY THAT INFORMATION WHICH IS PERTINENT. PROVIDE CONTROL DIAGRAM FOR EACH SYSTEM/EQUIPMENT CORRESPONDING TO ITS SEQUENCE OF OPERATION.
- c) SHOW ALL DIMENSIONS OF EACH ITEM OF EQUIPMENT ON A SINGLE COMPOSITE SHOP DRAWING, NOT ON A SERIES OF DRAWINGS. PROVIDE SEQUENCE OF OPERATION FOR EACH SYSTEM, ACCOMPANIED BY THE WIRING DIAGRAM.
- d) COORDINATE EACH SUBMITTAL WITH REQUIREMENTS OF THE WORK AND OF CONTRACT DOCUMENTS FOR DIVISIONS 15 AND 16 PRIOR TO REVIEW AND APPROVAL.
- e) NOTIFY THE OWNER IN WRITING AT TIME OF SUBMISSION OF DEVIATIONS IN SUBMITTALS FROM REQUIREMENTS OF CONTRACT DOCUMENTS.
- f) BEGIN NO INSTALLATION WORK WHICH REQUIRES SUBMITTALS UNTIL RETURN OF SUBMITTALS WITH PROPERLY EXECUTED STAMP INDICATING REVIEW AND APPROVAL.

##### 2) PROVIDE THE FOLLOWING SHOP DRAWINGS:

- a) MANUFACTURER'S DRAWINGS:
  - (1) CATALOGUE CUTS AND MANUFACTURER'S DRAWING OF ALL AUTOMATIC TEMPERATURE, PRESSURE AND CONTROL DEVICES, INCLUDING RANGES, SET POINTS, ADJUSTABILITY AND ACCESSORIES. IDENTIFY EACH SHEET TO CORRELATE EQUIPMENT DESIGNATION WITH INSTALLATION DRAWINGS.
- b) CONTROL DIAGRAMS:
  - (1) SUBMIT CONTROL DIAGRAMS FOR ALL CONTROL SCHEMES, WITH WRITTEN DESCRIPTION OF ALL CONTROL MODES AND FUNCTIONS FOR EACH SYSTEM:
    - (a) THE CONTROL SEQUENCE IN THE SPECIFICATIONS DESCRIBES THE PERFORMANCE OF THE VARIOUS SYSTEMS. PROVIDE ALL CONTROL ELEMENTS, FUNCTIONS AND WIRING FOR THE INTENDED SYSTEM OPERATION, AND SHOW SAME ON DIAGRAM.
- c) INSTALLATION DRAWINGS:
  - (1) FRONTAL EXTERIOR VIEW OF EACH LOCAL CONTROL PANEL SHOWING LOCATION OF SWITCHES, GAUGES AND PILOT LIGHTS, ASSOCIATED LABELS AND FLOW DIAGRAMS.
  - (2) INTERIOR VIEW OF LOCAL CONTROL PANELS SHOWING PHYSICAL LAYOUT OF ALL DEVICES, INTERCONNECTING WIRING AND IDENTIFICATION TAGS.
- d) GENERAL SCOPE OF WORK

- (1) PROVIDE A COMPLETE INSTALLATION OF PNEUMATIC/ELECTRONIC/DOC CONTROL SYSTEM FOR CONTROLLING, SUPERVISING AND AUTOMATICALLY MAINTAINING THE DESIRED SPACE CONDITIONS AS SET BY THE VARIOUS THERMOSTATS, PRESSURE SENSORS AND OTHER SENSORS AND CONTROLLERS SPECIFIED OR INDICATED.
- (2) THE ENTIRE CONTROL AND BUILDING MANAGEMENT SYSTEM (BMS) SHALL BE PROVIDED BY INDEPENDENT, STATA CONTROLS OR L-C POWERS AND INSTALLED UNDER THE MANUFACTURER'S SUPERVISION AND DIRECTION. THE SYSTEM SHALL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING FUNCTIONS:
  - (a) FUTURE FUNCTION/POINT EXPANDABILITY.
  - (b) INTERLOCKING WITH THE FUEL MANAGEMENT SYSTEM.
  - (c) SCHEDULED START-UP AT RESTORATION OF POWER AFTER AN ELECTRICAL OUTAGE.
  - (d) PROGRAMMED START/STOP.
  - (e) EXECUTION OF LIFE SAFETY INSTRUCTIONS RECEIVED FROM FIRE COMMAND CENTER, ETC.
  - (f) DIAGNOSTIC SYSTEM DISPLAY FOR EACH HVAC SYSTEM.
- (3) CONTROL SYSTEM SHALL BE AUTOMATIC IN OPERATION AND SHALL UTILIZE COMPRESSED AIR FOR PNEUMATIC SIGNALS AND FOR PNEUMATICALLY OPERATED ACTUATORS SUCH AS CONTROL VALVE AND DAMPER PNEUMATIC MOTORS.
- (4) ALL PROPORTIONING TYPE DAMPERS SHALL HAVE PNEUMATIC ACTUATORS; UNIT HEATERS SHALL BE ELECTRIC MOTOR ACTUATED VIA ELECTRIC LINE VOLTAGE THERMOSTATS.
- (5) IT SHALL BE THE DIVISION 15 CONTRACTOR'S RESPONSIBILITY TO EMPLOY TEMPERATURE CONTROL AND FUEL MANAGEMENT SYSTEM MANUFACTURERS UTILIZING COMPATIBLE SIGNALS AND COMPATIBLE EQUIPMENT WITH EACH OTHERS SYSTEMS AND THE BASE BUILDING SCADA SYSTEM.

### 2. PRODUCTS

#### A. PNEUMATIC ROOM THERMOSTATS (BYPASS DAMPERS)

- 1) IN MECHS AND OTHER UTILITY AREAS, PNEUMATIC ROOM OR RETURN AIR THERMOSTATS SHALL BE FULLY PROPORTIONING WITH FEEDBACK, UNLESS OTHERWISE SPECIFIED, SHALL HAVE ADJUSTABLE SENSITIVITY OR THROTTLING RANGE, AND A SCALE RANGE OF AT LEAST 30 DEG. F. THE CONTROL POINT SHALL BE ADJUSTABLE TO DEG. F. ABOVE AND BELOW ITS INTENDED SETTING.
- 2) PNEUMATIC THERMOSTATS SHALL BE CAPABLE OF CONTROLLING WITH PLUS OR MINUS 1/2 DEG. F., AND SHALL BE RESPONSIVE TO A 1/4 DEG. F. CHANGE.

#### B. DAMPERS OPERATORS

- 1) ALL DAMPER OPERATORS SHALL BE OF THE MOLDED SYNTHETIC RUBBER DIAPHRAGM PISTON TYPE, SHALL BE FULLY PROPORTIONING, UNLESS OTHERWISE SPECIFIED. THEY SHALL BE QUIET IN OPERATION AND SHALL HAVE AMPLE POWER TO OVERCOME FRICTION OF DAMPER LINKAGE AND AIR PRESSURE ACTING ON LOUVERS TO POSITION DAMPERS ACCURATELY AND SMOOTHLY. THE DAMPER OPERATOR MOUNTING ARRANGEMENT SHALL BE OUTSIDE THE AIR STREAM WHEREVER POSSIBLE. THE OPERATORS SHALL BE CAPABLE OF OPERATING AT VARYING RATES OF SPEED TO CORRESPOND TO THE DEVICES OF THE CONTROLLERS AND VARIABLE LOAD REQUIREMENTS. THE OPERATORS SHALL BE CAPABLE OF OPERATING IN SEQUENCE WHEN REQUIRED BY THE SEQUENCE OF OPERATION. THE OPERATORS SHALL HAVE EXTERNAL ADJUSTABLE STOPS TO LIMIT THE STROKE IN EITHER DIRECTION. THE OPERATOR LINKAGE ARRANGEMENT SHALL BE SUCH AS TO PERMIT NORMALLY CLOSED POSITIONS OF THE DAMPERS AS REQUIRED.

#### C. DAMPERS

- 1) ALL AUTOMATICALLY CONTROLLED DAMPERS SHALL BE THE OPPOSED BLADE TYPE. THE DAMPERS SHALL HAVE BLADES OF 16 GAUGE GALVANIZED STEEL, WITH A MAXIMUM WIDTH OF FORTY (40) INCHES AND MAXIMUM LENGTH OF FORTY-FOUR (44) INCHES. THE BEARING SHALL BE NON-FERROUS SLIDE TYPE. THE FRAMES SHALL BE OF 2" X 1/2" CHANNEL IRON UNPAINTED, WITH WELDED CORNERS AND STIFFENING MEMBERS TO FORM A RIGID ASSEMBLY. ALL DAMPERS SHALL HAVE BOTH BLADES AND FRAMES GALVANIZED. ALL DAMPERS SHALL HAVE 50" F. STOPS WITH VINYL EDGING TO INTERLOCK IN ORDER TO PREVENT LEAKAGE WHEN DAMPERS ARE CLOSED. MAXIMUM LEAKAGE WHEN IN CLOSED POSITION SHALL NOT EXCEED 1% OF FULL FLOW AT 4" STATIC PRESSURE DIFFERENCE. ALL AUTOMATIC DAMPERS SHALL BE SUPPLIED AND MANUFACTURED BY THE AUTOMATIC TEMPERATURE CONTROL MANUFACTURER.
- 2) DAMPERS MAY BE SIZED BY CONTROL MANUFACTURER, HOWEVER, THE FRAME SIZE OF THE DAMPERS SHALL BE FULL DUCT SIZE. NO DAMPER SHALL BE SIZED FOR HIGHER THAN 1200 FPM FACE VELOCITY UNLESS INDICATED OTHERWISE.

#### D. AIR PIPING

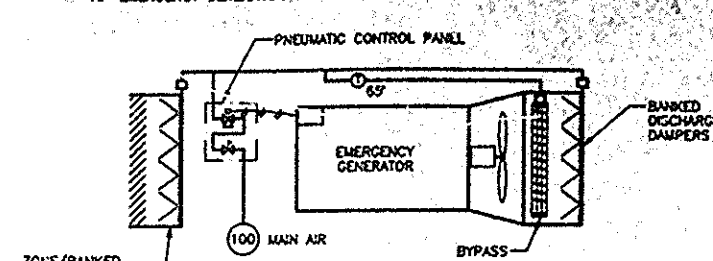
- 1) THE CONTROL AIR PIPING SHALL BE OF 3/8" SEAMLESS COPPER TUBING WITH SOLDER FITTINGS WHERE CONCEALED IN CONSTRUCTION AND SOLDERED, FLARED OR COMPRESSION TYPE FITTINGS WHERE EXPOSED. THE CONTROL PIPING SHALL BE SOFT COUPLER IN CONCEALED LOCATIONS AND WHERE EXPOSED, PIPING SHALL BE HARD TEMPER COPPER TUBING. PIPING SHALL BE RUN HORIZONTALLY LEVEL AND VERTICALLY PLUMB, WITH REASONABLE DRAIN TO DRAIN POCKETS. ALL LOW POINTS IN MAINS AND RISERS SHALL BE INSTALLED WITH VALVED DRAIN POCKETS. NO AIRLINES SHALL BE HIDDEN WITHIN DUCT INSTALLATION. ALL PIPING AND AIRLINES SHALL BE PROPERLY SUPPORTED USING STRAPS, CLEATS OR HANGERS AS APPROVED. USE OF WIRE OR TAPE TO SUPPORT PIPING OR TUBING SHALL NOT BE PERMITTED. ALL AIR PIPING SHALL BE TESTED UNDER A PRESSURE OF THIRTY (30) POUNDS FOR A PERIOD OF TWENTY-FOUR (24) HOURS, DURING WHICH TIME THE AIR PRESSURE DROP SHALL NOT EXCEED TEN (10) POUNDS.
- 2) ALL HIGH PRESSURE (80-100 PSIG) AIR PIPING SHALL BE COPPER.
  - a) WITHIN MECHANICAL EQUIPMENT ROOMS AS NOTED.
  - b) WITHIN CONTROL PANELS AND CABINETS.

#### E. GAUGES

- 1) AIR PRESSURE INDICATING GAUGES OF AT LEAST 1-1/2" IN DIAMETER SHALL BE FURNISHED AND INSTALLED TO INDICATE THE VARIOUS CONTROL AIR PRESSURES FOR EACH CONTROL DEVICE, SUCH AS RELAYS, SWITCHES AND P-E AND E-P RELAYS. PLUGGED TEST AIR GAUGE CONNECTION SHALL BE FURNISHED AND INSTALLED AT EACH CONTROLLED DEVICE SUCH AS DAMPER MOTORS. A MAIN AIR PRESSURE GAUGE SHALL BE FURNISHED AND INSTALLED AT THE MAIN LOCAL CONTROL PANEL INSTALLED IN THE BUILDING.

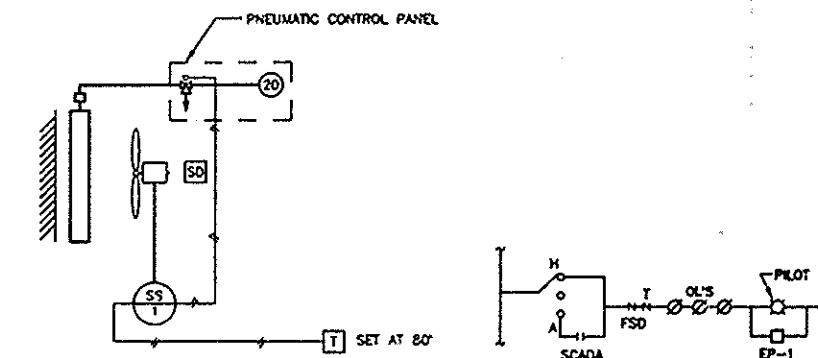
### 3. SEQUENCE OF OPERATION

#### A. EMERGENCY GENERATOR



- 1) MAIN AIR AT 100 PSI FROM THE 9TH FLOOR MECH. TO BE FED TO THE PNEUMATIC CONTROL PANEL, WHERE IT IS REDUCED TO 20 PSI WITH A PRESSURE REDUCING VALVE. THE TEMPERATURE CONTROL CONTRACTOR TO PROVIDE A PNEUMATIC CONTROL PANEL OF EQUIVALENT SIZE TO HOUSE ALL EP SWITCHES FOR ALL SYSTEMS IN THE BUILDING.
- 2) A START SIGNAL FROM AN INDIVIDUAL EMERGENCY GENERATOR SHALL ENERGIZE ITS DEDICATED EP SWITCH AND PRESSURIZE THE ZONED DAMPER OPERATORS FOR THE INTAKE AND DISCHARGE DAMPERS. DAMPERS SHALL BE FULLY OPEN WITHIN 10 SECONDS.
- 3) THE BYPASS DAMPERS PNEUMATIC THERMOSTAT SHALL BE ENERGIZED ANY TIME THE GENERATOR IS ENERGIZED. THE PNEUMATIC DAMPERS WILL OPEN IF THE THERMOSTAT READS 65 F OR BELOW.

#### B. EXHAUST FANS



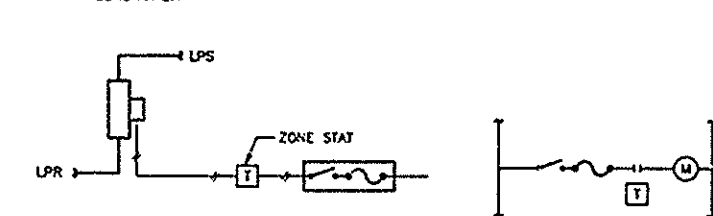
### CONTROL DIAGRAM FF-1 & 2

NOT TO SCALE

- 1) FF-1 AND FF-2 SEQUENCE OF OPERATION
- 2) START/STOP CONTROL.
  - a) THE FAN MAY BE STARTED AND STOPPED LOCALLY AT THE MOTOR STARTER HAND-OFF-AUTOMATIC SWITCH. WHEN THE HSA IS IN THE AUTOMATIC POSITION, THE FAN MAY BE STARTED/STOPPED THROUGH THE SCADA SYSTEM EITHER MANUALLY BY A KEYBOARD COMMAND OR AUTOMATICALLY ACCORDING TO A PROGRAMMED TIME SCHEDULE. AS LONG AS THE ROOM TEMPERATURE IS ABOVE 80 F.
- 3) WHEN THE FAN IS ENERGIZED AND THE ROOM TEMPERATURE IS ABOVE 80 F, EP-1 WILL BE ENERGIZED AND PNEUMATIC DAMPER MOTOR SHALL DRIVE DISCHARGE DAMPER OPEN.
- 4) IF THE ROOM TEMPERATURE IS BELOW 80 F, THE FAN SHALL REMAIN OFF, EP-1 WILL VENT POSITION, AND DISCHARGE DAMPER SHALL CLOSE.
- 5) IF LOSS OF POWER, UNITS SHALL RESTART WHEN POWER IS RESTORED ON A SCHEDULED STARTUP PROGRAM.
- 6) SMOKE DETECTOR ON "F" ON SIDE SHALL SHUT DOWN EXHAUST FAN AND ALARM FIRE COMMAND STATION.

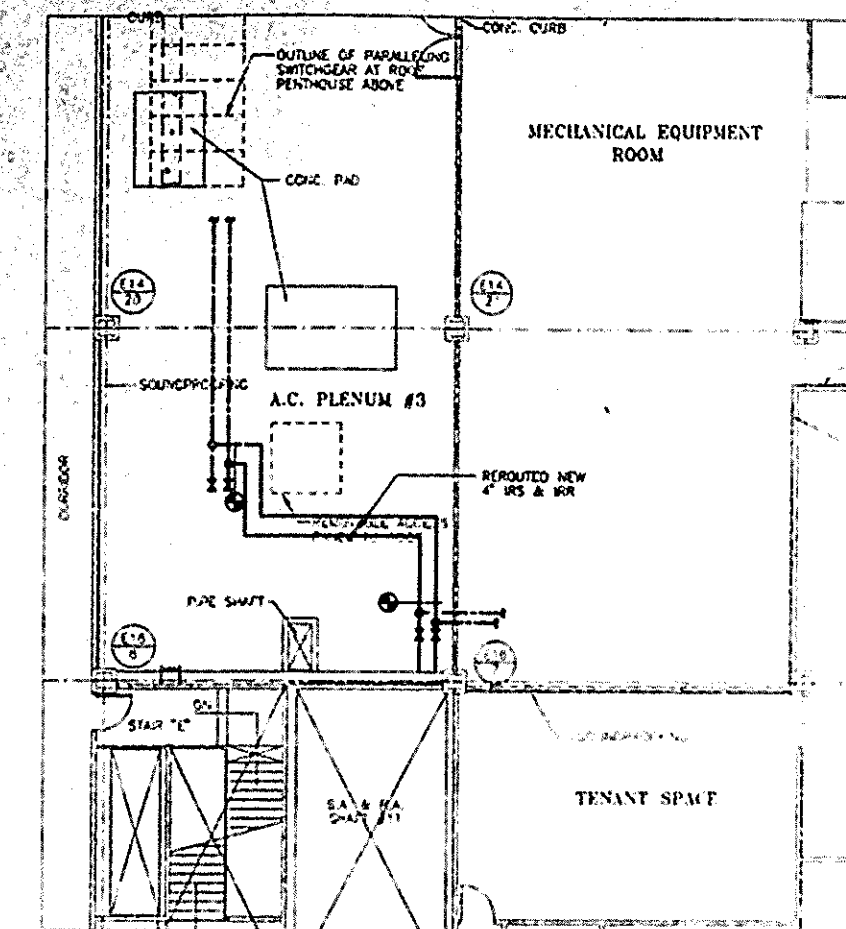
#### C. UNIT HEATERS

- 1) UN-1 THROUGH UN-12 SEQUENCE OF OPERATION.
- 2) UNIT HEATERS MAY BE STARTED AND STOPPED LOCALLY AT THE UNIT THROUGH A FUSED DISCONNECT SWITCH.
- 3) WHEN THE UNIT HEATER IS ENERGIZED AND THE ZONE THERMOSTAT SHALL MAINTAIN THE ROOM TEMPERATURE AT 85 F, FAN SHALL CYCLE TO MAINTAIN THE TEMPERATURE.
- 4) IN WINTER, IF THE GENERATORS SHOULD OPERATE, THE UNIT HEATERS WILL BE ON CONSTANTLY.

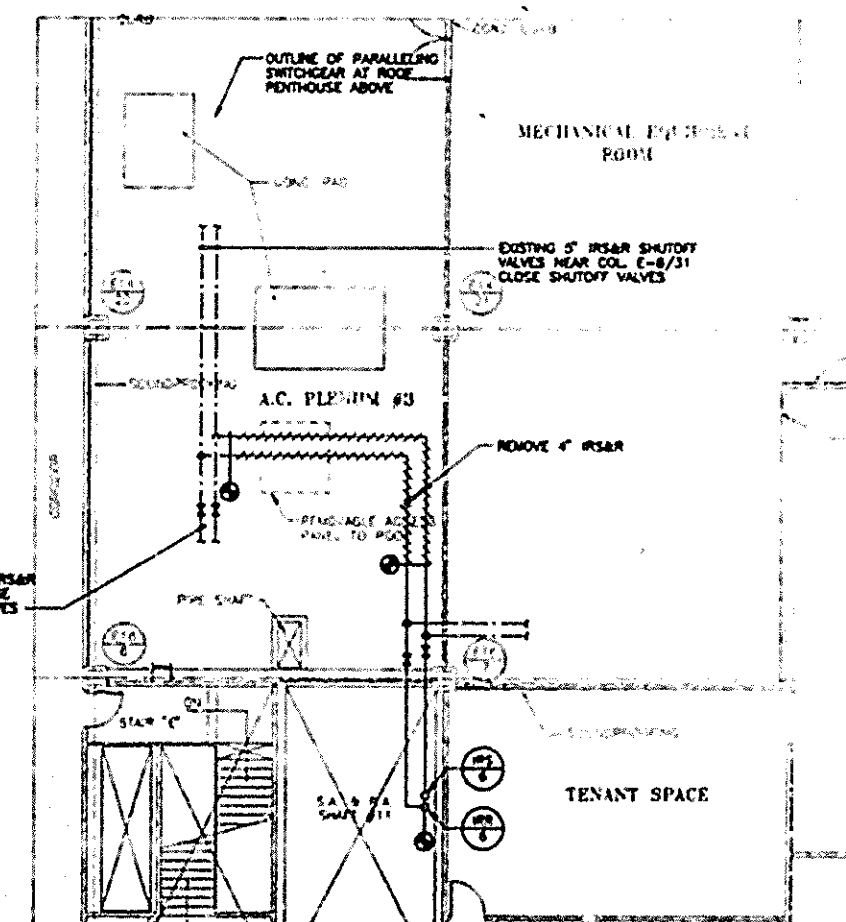


### FF-1 & 2 WIRING DIAGRAM

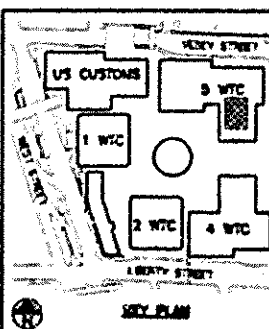
NOT TO SCALE



### 9TH FLOOR PART PLAN



### REMOVAL PART PLAN



THE PORT AUTHORITY OF NY & NJ

CONFORMED DRAWING  
08/2/98  
SIGNED AND SEALED  
COPY IS KEPT ON FILE

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No. Date Revision Approval

Engineering Department  
Design Division

The  
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STANDBY POWER  
5 WORLD TRADE CENTER

MECHANICAL  
PART PLANS  
AND  
GENERAL NOTES

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J.D. M.A.P. C.H.K.  
Designed by Drawn by Check by  
Date 11/17/97  
Contract Number WTC-945.071  
Drawing Number M-08